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# Journal Packing Density of Subject Disciplines at the Continental level: A study

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# Journal Packing Density of Subject Disciplines at the Continental level: A study

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## ABSTRACT

**Purpose:** -The present study has been undertaken with the view to assess the Journal Packing Density (JPD) of research journals published in different subject disciplines across different continents of the world. The study evaluates the average number of research articles published in each volume of a research journal published in a particular subject discipline. The other aspects evaluated in the study include, the subject disciplines with leading JPD at the continental level, the existing difference in the JPD among subject disciplines at the continental level, leading subject disciplines having maximum JPD at the global level and more. An overall comparison has been drawn of the JPD of subject disciplines at the continental level.

**Scope and Methodology:** - The study is global in nature and encompasses the 27 major subject disciplines across six different continents of the world. The study is based on the secondary data retrieved from the SCImago Journal and Country Ranking for the period 2013-15.

**Findings:** - On the date of data retrieval, 36081 research journals were found indexed by the SCImago across different continents. Of the total journals indexed by the SCOPUS, Europe emerged the leading continent to have 20336 (56.36%) research journals

indexed, followed by North America with 10224 (33.48%) and Asia with 3746 (10.38%) journal indexed. The average Journal Packing Density at the global level is 101.84 research articles per journal per volume. North America leads in the average JPD with an average of 120.33 research articles per journal per volume. Asia and Europe are the other two leading continents having an average JPD of 111.81 and 95.14 research articles per journal per volume. The average JPD of South America is 55.32 research articles, Africa 46.58 research articles and Oceania 46.50 research articles per journal per volume. Chemistry, Physics & Astronomy and Multidisciplinary journals are the three leading subject disciplines to have the maximum average JPD of 266.66, 253.92 and 242.53 research articles per journal per volume.

**Research Implication:** - There is a considerable difference in the JPD of the research journals published among different subject discipline across different continents. The indexing of lesser number of research journals from the continents like Africa, Australia and South America can be owed to the poor quality of research journals published from various countries of these continents. Given the number of research journals indexed from continents like, Asia, Europe and North America, somewhere reflects the research prowess of these continents.

**Key words:** Research Journals, Continents, Publishing, Subject Discipline, Subject Ranking Journal Packing Density

**Introduction:** - A manifold growth is being witnessed in the research activities all across the globe. Each year, approximately 2.5 million scientific papers are added to the existing lot of research (Boon, 2016). This gets substantiated by the facts and figures put forth by Reller who in his study estimated around 70.8 million researchers active across the globe (Reller, 2016). Reller further maintains that research results published across Elsevier research journals during 2015 constituted only 16% of the total scientific output at the global level.

This exponential growth in research activities if on one hand has helped in extending the frontiers of knowledge and information, on the other hand, it has become equally difficult for the information seekers to keep track of all the new research findings in his/her areas of interest. The greater the research activities undertaken in a particular country, region or even in a subject discipline, greater will be the research output. There is no point in having an increased research output unless the research results are not made public by publishing findings in the reputed and well recognized research journals in different subject disciplines all across the world. These increased research activities ultimately put pressure on the reputed and well recognized research journals

to publish these research results in time bound manner. Pressure of publishing is being faced by the research journals with the manifold increase in the receipt of new manuscripts, which ultimately starts taking a toll on the Journal Packing Density (JPD) of a research journal.

By Journal Packing Density (JPD) we mean the average number of research articles published in each volume or each issue of a research journal. Normally it is being observed the JPD of research journals remains same, with slight  $\pm$  exception of some research articles published in volume to volume basis or issue to issue basis. An increase in the receipt of manuscripts of good research findings by the research journals for publication means these journals are pushed for their packing density to accommodate more and more research articles in each issue they publish. Still more, research journals published in hybrid form viz. both print and electronic form have their own limitations to not to push beyond a particular density point. However, the research journals published only in electronic form do not face any such limitations hence more often such journals have been observed of pushing beyond their packing density. Although online research journals, which do not follow any specific standard in publishing are being termed as predatory journals and rightly so, as the ultimate aim of all such journals is to mint money and not to promote or contribute to research in true sense.

Journal Packing Density has been defined differently by different people, depending upon the context in which the concept is being applied. According to **Basu**, the “Journal Packing Density (JPD) for a country is defined as the ratio of the number of papers published in a country’s own journals to the number of journals published” (Basu, 2010). However, in the present study, an attempt has been made to determine the Journal Packing Density of research journals published in different subject disciplines all across the world. It would be quite unfair to limit the concept of JPD to seek-out the ratio of country’s research output published in the country’s research journals. The present study has been under taken at the continental level to assess the existing JPD differences among different subject disciplines across different continents. In the present study JPD has been computed by working out the average number of research articles published in per journal per volume. The study is based on the research articles published in the research journals indexed by the SCImago journal and Country Ranking, which is based on SCOPUS data source. Hence JPD can also be defined as ‘the average number of research articles published in each issue or each volume of a research journal’.

**RELATED LITERATURE:** - A good number of studies have been conducted to assess the research growth across different subject disciplines across the world, but there are a

very few studies, which actually discuss about the concept of Journal Packing Density. However, studies assessing the research output of the subject disciplines across countries or at the continental level can be seen closer to the concept of JPD, as how research growth leads to inflate the Journal Packing Density.

China is being seen as one of the fastest emerging research countries in the world, given the amount of research output China reported during the last couple of decades, especially in the field of social sciences (Liu, Hu, Tang, & Wang, 2015). As per the SCImago data, in 1996, China was the world's 9<sup>th</sup> leading research country, as 2.65% of the global research output was reported alone from China. While as, in 2015 China became the world's second largest research country by contributing 13.82% of the total global research output (SCImago, 2017). While assessing the unusual scientific productivity of the China, (Basu, 2010) owed it to the Journal Packing Density of the research Journals published from the China, which the author reported double the average Journal Packing Density of the world.

Promoting research activities across the countries have almost become a global phenomenon, this has resulted into the increase in scientific productivity, which ultimately puts pressure on the existing number of research journals to publish more and more research results. From the year 2000 to 2009 the research journals on average grew at the rate of 18% and research articles at the rate of 30% per annum (Laakso et al., 2011). These findings are indicative of the fact that the research journal and the scientific productivity do not grow at the uniform pace, which affects the JPD of a research journal. Similarly, on average Open Access (OA) research journals indexed by the SCOPUS from 2000 to 2015 grew at the rate of 15.8% per annum, while as the research articles published in these OA journals for the same period grew at the rate of 24.53%, which again corroborates the fact that any inflation or deflation in JPD is due to the existing difference in the growth of research journals and the scientific productivity published in these research journals<sup>4</sup>. The findings reflect that the growth rate of research journals and research articles is not uniform, hence puts extra pressure of publishing on existing research journals to publish greater number of research articles, which ultimately results in an increase in their JPD.

To assess the growth of Open Access research journals at the continental level, (Pandita, 2013) found 8518 Open Access research journals were being published across 121 countries across the six different continents of the world. The researcher found that Europe, North America and the Asia are the three leading continents to publish the open access journals. An increased research activity has a direct bearing on the research output and so does it affect the JPD and boosts the introduction of new research

journals. During the period 2005-2010, the research journals in India showed an average annual corresponding growth of 3.29%, while as research output during the same period showed an average annual corresponding growth of 5.44% (Singh & Pandita, 2017). Research journals indexed by good indexes like WoS, SCOPUS etc. face more pressure of publishing hence show higher JPD. This gets better corroborated by (Björk, Roos, & Lauri, 2009) who assessed research journals indexed by ISI and Ulrich's Periodical Directory and found that ISI research journals on average publish 111 research articles per journal per volume, while as non ISI indexed journals published 26 research articles per journal per volume.

Disproportionate growth in the scientific productivity and the introduction of new research journals affects the JPD of a research journal. In the year 2015 approximately 1.3 million manuscripts were submitted to the Elsevier journals for publication, out of which nearly 4.00 lakh manuscripts were published in about 2500 research journals with the JPD of 160 research articles per volume (Reller, 2016). During the year 2015, 73 new research journals were indexed by Elsevier recording a growth of 2.92%, which is not in proportion to the corresponding growth of research articles published during the last year. More than 28100 well recognized peer reviewed scholarly research journals are published all across the world, but still these research journals fall short of publishing all the research results submitted to them, with the result a good number of studies ultimately become the prey of various predatory and fake scientific journals (Boon, 2016). The author also views that nearly 4% to 5%, researchers join the existing lot of scientific communities each year.

**Materials and Methods:** - The study is based on the secondary data retrieved from the SCImago Journal and Country Ranking on January 25, 2017 accessible at <http://www.scimagojr.com/> (SCImago, 2017). The data were structured as per the objectives of the study. In order to validate the results and make findings more applicable, the data were retrieved for a three year period, viz., 2013 through 2015. Average research output against each subject discipline has been worked out against each individual continent and then average JPD has been calculated per volume of the journal by dividing the average research articles published among the total number of research journals. Although, there are considerable variations in the volume information carried by each individual journal, mostly depending upon the policy matter of each individual journal. Some journals complete one volume in every three or four months, others in six months and a few others have other periodicity, but by and large it is being observed that on average each research journal completes one volume

in one calendar year. Accordingly, JPD in the undergoing study has been computed for one calendar year, for all the subject disciplines under study across all the continents.

The study is global in nature. The JPD has been calculated individually for all the subject disciplines across six continents. The JPD against each subject discipline under each table has been computed by applying the following method.

Methodology for computing JPD

*SJ= Total research journals published in a Subject*

*SA= Total research articles published in a Subject*

*C= Time period (three years)*

*D= Average research articles published in a Subject one year*

$$D = \frac{SA}{C} ; JPD = \frac{D}{SJ}$$

***Understand from the table-1 we have to compute the JPD of Medicine from Africa***

Let *SJ= Total research journals published in Medicine = 94*

*SA= Total research articles published in Medicine from 2013-15 (3 years) = 16104*

*C= Time period (three years) = 3 years*

*D= Average research articles published in Medicine in one year from Africa*

$$\text{Therefore } D = \frac{SA}{C} = \frac{16104}{3} = 5368 \text{ (Research articles per year)}$$

*Therefore, average number of research articles published in each journal of medicine in one year = 5368 research articles*

$$\text{Therefore JPD of Medicine in Africs } JPD = \frac{D}{SJ} = \frac{5368}{94} = 57.11$$

*Therefore, Average JPD of Medicine in Africa = 57.11 research articles per journal per volume.*

***The method has been applied in all tables across all subject disciplines against each continent***

**OBJECTIVES OF THE STUDY:** -To compute the average Journal Packing Density of research journals published in different subject disciplines across different continents.

To identify the most popular subject discipline against each individual continent on the basis of their Journal Packing Density

To identify the most popular country against each individual continent on the basis of their Journal Packing Density

To assess the average Journal Packing Density of research journals published across the world

**Data Analysis:** - To undertake the data analysis and to perform the simple mathematical expressions like, addition, subtraction, division and the drawing percentage etc., MS excel was used. Percentage at most of the places has been rounded off and has been drawn up to two decimal places.

**Table-1 JPD of research journals published across different subject disciplines in Africa**

| Rank | Subject field                                | Number of Journals<br>(% Share) | Research articles<br>published<br>2013-15<br>(% Share) | Average<br>articles<br>published per<br>year | Avg JPD<br>per<br>Volume | H_index<br>Average |
|------|--|---------------------------------|--|--|--------------------------|--------------------|
| 01   | Materials Science                            | 6 (2.04)                        | 1303 (3.17)  | 434.33                                       | 72.39                    | 15.00              |
| 02   | Pharmacology, Toxicology and Pharmaceutics   | 8 (2.72)                        | 1549 (3.77)  | 516.33                                       | 64.54                    | 11.13              |
| 03   | Energy                                       | 2 (0.68)                        | 355 (0.86)   | 118.33                                       | 59.17                    | 10.50              |
| 04   | Mathematics                                  | 9 (3.06)                        | 1547 (3.77)  | 515.67                                       | 57.30                    | 11.00              |
| 05   | Engineering                                  | 14 (4.76)                       | 2404 (5.85)  | 801.33                                       | 57.24                    | 7.86               |
| 06   | Medicine                                     | 94 (31.97)                      | 16104 (39.20)  | 5368.00                                      | 57.11                    | 11.91              |
| 07   | Immunology and Microbiology                  | 9 (3.06)                        | 1398 (3.40)  | 466.00                                       | 51.78                    | 22.00              |
| 08   | Environmental Science                        | 15 (5.10)                       | 2283 (5.56)  | 761.00                                       | 50.73                    | 11.93              |
| 09   | Veterinary                                   | 3 (1.02)                        | 415 (1.01)   | 138.33                                       | 46.11                    | 23.00              |
| 10   | Earth and Planetary Sciences                 | 10 (3.40)                       | 1366 (3.33)  | 455.33                                       | 45.53                    | 14.10              |
| 11   | Multidisciplinary                            | 2 (0.68)                        | 270 (0.66)   | 90.00  | 45.00                    | 15.00              |
| 12   | Biochemistry, Genetics and Molecular Biology | 10 (3.40)                       | 1335 (3.25)  | 445.00                                       | 44.50                    | 19.30              |
| 13   | Agricultural and Biological Sciences         | 24 (8.16)                       | 3040 (7.40)  | 1013.33                                      | 42.22                    | 17.17              |
| 14   | Neuroscience                                 | 3 (1.02)                        | 374 (0.91)   | 127.67                                       | 41.56                    | 12.67              |
| 15   | Chemistry                                    | 6 (2.04)                        | 730 (1.78)   | 243.33                                       | 40.56                    | 12.00              |
| 16   | Nursing                                      | 6 (2.04)                        | 668 (1.63)   | 222.67                                       | 37.11                    | 9.50               |
| 17   | Psychology                                   | 4 (1.36)                        | 406 (0.99)   | 135.33                                       | 33.83                    | 12.50              |
| 18   | Arts and Humanities                          | 15 (5.10)                       | 1455 (3.54)  | 485.00                                       | 32.33                    | 5.87               |
| 19   | Physics and Astronomy                        | 6 (2.04)                        | 484 (1.18)   | 161.33                                       | 26.89                    | 9.33               |
| 20   | Social Sciences                              | 28 (9.52)                       | 2235 (5.44)  | 745.00                                       | 26.61                    | 7.86               |
| 21   | Business, Management and Accounting          | 3 (1.02)                        | 236 (0.57)   | 78.67  | 26.22                    | 7.33               |
| 22   | Computer Science                             | 7 (2.38)                        | 530 (1.29)   | 176.67                                       | 25.24                    | 9.71               |
| 23   | Health Professions                           | 2 (0.68)                        | 149 (0.36)   | 49.67  | 24.83                    | 10.50              |
| 24   | Decision Sciences                            | 2 (0.68)                        | 125 (0.30)   | 41.67  | 20.83                    | 6.50               |
| 25   | Economics, Econometrics and Finance          | 6 (2.04)                        | 321 (0.78)   | 107.00                                       | 17.83                    | 6.17               |
|      | Total (Average)*                             | 294<br>(11.86)*                 | 41082<br>(1643.28)*                                    | 13694.00<br>(547.76)*                        | 46.58                    | 11.88              |

In all 294 research journals are published from the Africa and indexed by the SCOPUS in 25 different subject disciplines at an average of 11.76 research journals in each subject discipline. The average journal packing density of research journals published from the Africa is 46.58 research articles per volume. During the period of study, 41082 research articles were published across 25 major subject disciplines in Africa at an average of 1643.28 research articles. The Material Sciences is the leading subject discipline from the



Africa having an average Journal Packing Density of 72.39 research articles per volume. Material Science is followed by subject disciplines like Pharmacology, Toxicology and Pharmaceutics and Energy with an average JPD of 64.54 and 59.17 research articles respectively. The subject discipline of Economics, Econometrics and Finance has the lowest JPD of 17.83 research articles per volume. Of all the subject disciplines under study from Africa, 68 % have less than the average JPD of the Africa. Medicine (94, 31.97%), Social Sciences (28, 9.52%) and Agriculture & Biological Sciences (24, 8.16%) are the three leading subject disciplines in which maximum number of research journals are published from Africa, while as, only two research journals each are published in the subject disciplines of Energy, Multidisciplinary, Health Profession and Decision Sciences, the lowest among all the subject disciplines.

There is almost a direct correlation between the number of journals published in a particular subject discipline and the average journal packing density. Higher the number of journals published in a particular subject discipline lower is the JPD and vice-versa. Similarly, there is no direct correlation between the JPD and the H-index. A good number of subject disciplines having higher JPD have the lower h-index and vice-versa.

**Table-2 JPD of research journals published across different subject disciplines in Asia**

| Rank | Subject field                                | Number of Journals<br>(% Share) | Research articles<br>published<br>2013-15<br>(% Share) | Average<br>articles<br>published<br>per year | Avg JPD<br>per<br>Volume | H_index<br>Average |
|------|--|---------------------------------|--|--|--------------------------|--------------------|
| 01   | Physics and Astronomy                        | 141 (3.76)                      | 84320 (6.71)   | 28106.67                                     | 199.34                   | 21.29              |
| 02   | Multidisciplinary                            | 57 (1.52)                       | 30009 (2.39)   | 10003.00                                     | 175.49                   | 15.32              |
| 03   | Chemistry                                    | 111 (2.96)                      | 57059 (4.54)   | 19019.67                                     | 171.35                   | 20.39              |
| 04   | Energy                                       | 68 (1.82)                       | 30652 (2.44)   | 10217.33                                     | 150.25                   | 13.12              |
| 05   | Engineering                                  | 467 (12.47)                     | 207110 (16.48)   | 69036.67                                     | 147.83                   | 13.82              |
| 06   | Materials Science                            | 186 (4.97)                      | 74800 (5.95)   | 24933.33                                     | 134.05                   | 14.77              |
| 07   | Computer Science                             | 164 (4.38)                      | 63429 (5.05)   | 21143.00                                     | 128.92                   | 15.57              |
| 08   | Chemical Engineering                         | 96 (2.56)                       | 36421 (2.90)   | 12140.33                                     | 126.46                   | 13.44              |
| 09   | Pharmacology, Toxicology and Pharmaceutics   | 140 (3.74)                      | 52566 (4.18)   | 17522.00                                     | 125.16                   | 14.47              |
| 10   | Biochemistry, Genetics and Molecular Biology | 212 (5.66)                      | 75061 (5.97)   | 25020.33                                     | 118.02                   | 17.14              |
| 11   | Veterinary                                   | 30 (0.80)                       | 9528 (0.76)  | 3176.00                                      | 105.87                   | 12.87              |
| 12   | Medicine                                     | 781 (20.85)                     | 246863 (19.65)   | 82287.67                                     | 105.36                   | 13.55              |
| 13   | Environmental Science                        | 117 (3.12)                      | 36712 (2.92)   | 12237.33                                     | 104.59                   | 12.39              |
| 14   | Earth and Planetary Sciences                 | 160 (4.27)                      | 49539 (3.94)   | 16513.00                                     | 103.21                   | 15.88              |
| 15   | Immunology and Microbiology                  | 57 (1.52)                       | 16979 (1.35)   | 5659.67                                      | 99.29                    | 17.07              |
| 16   | Mathematics                                  | 158 (4.22)                      | 45427 (3.62)   | 15142.33                                     | 95.84                    | 14.87              |
| 17   | Agricultural and Biological Sciences         | 255 (6.81)                      | 69202 (5.51)   | 23067.33                                     | 90.46                    | 13.36              |
| 18   | Neuroscience                                 | 31 (0.83)                       | 7210 (0.57)  | 2403.33                                      | 77.53                    | 10.23              |
| 19   | Nursing                                      | 28 (0.75)                       | 5731 (0.46)  | 1910.33                                      | 68.23                    | 12.36              |
| 20   | Dentistry                                    | 24 (0.64)                       | 4572 (0.36)  | 1524.00                                      | 63.50                    | 11.67              |
| 21   | Health Professions                           | 20 (0.53)                       | 3195 (0.25)  | 1065.00                                      | 53.25                    | 9.40               |
| 22   | Economics, Econometrics and Finance          | 45 (1.20)                       | 6237 (0.50)  | 2079.00                                      | 46.20                    | 5.69               |
| 23   | Social Sciences                              | 199 (5.31)                      | 24326 (1.94)   | 8108.67                                      | 40.75                    | 6.52               |
| 24   | Decision Sciences                            | 17 (0.45)                       | 1779 (0.14)  | 593.00                                       | 34.88                    | 13.47              |

|    |                                     |                   |                        |                          |        |       |
|----|-------------------------------------|-------------------|------------------------|--------------------------|--------|-------|
| 25 | Psychology                          | 20 (0.53)         | 2081 (0.17)            | 693.67                   | 34.68  | 8.45  |
| 26 | Business, Management and Accounting | 72 (1.92)         | 7139 (0.57)            | 2379.67                  | 33.05  | 6.60  |
| 27 | Arts and Humanities                 | 90 (2.40)         | 8534 (0.68)            | 2844.67                  | 31.61  | 3.43  |
|    | Total (Average)*                    | 3746<br>(138.74)* | 1256481<br>(46536.33)* | 418827.00<br>(15512.11)* | 111.81 | 13.69 |

Although Asia is one of the largest continents in the world, but the same does not hold true about the continent when it comes to the research output. In all 3746 research journals are indexed by the SCOPUS are from Asia are indexed by the SCOPUS published from Asia in 27 different subject disciplines at an average of 138.74 research journals in each subject discipline. On average 46536.33 research articles were published in each subject discipline from Asia during the period of study at an average of 15512.11 research articles each year. The average JPD of research articles in the research journals published from Asia is 111.81 research articles in each volume. Over 62% subject disciplines under study have recorded less than the average JPD of the Asia. Physics and Astronomy is the leading subject discipline to record the highest average JPD of 199.34 research articles published in each volume of the research journals published in the given subject discipline from Asia. Multidisciplinary and Chemistry journals are the other two leading subject disciplines to have an average JPD of 175.49 and 171.35 research articles respectively. Arts and Humanities subject discipline has recorded the lowest JPD of 31.61 research articles per volume. Like in Africa, Medicine is the leading subject discipline from the Asia to have maximum 781 journals and Decision Science has the lowest 17 journals indexed by the SCOPUS.

**Table-3 JPD of research journals published across different subject disciplines in Europe**

| Rank | Subject field                                | Number of Journals<br>(% Share) | Research articles<br>published<br>2013-15<br>(% Share) | Average<br>articles<br>published<br>per year | Avg JPD<br>per<br>Volume | H_index<br>Average |
|------|--|---------------------------------|--|--|--------------------------|--------------------|
| 01   | Chemistry                                    | 463 (2.28)                      | 398407 (6.86)  | 132802.33                                    | 286.83                   | 54.43              |
| 02   | Multidisciplinary                            | 26 (0.13)                       | 21682 (0.37)   | 7227.33                                      | 277.97                   | 50.23              |
| 03   | Physics and Astronomy                        | 538 (2.65)                      | 386231 (6.65)  | 128743.70                                    | 239.30                   | 48.86              |
| 04   | Chemical Engineering                         | 301 (1.48)                      | 192551 (3.32)  | 64183.67                                     | 213.24                   | 46.80              |
| 05   | Materials Science                            | 620 (3.05)                      | 367829 (6.34)  | 122609.70                                    | 197.76                   | 40.38              |
| 06   | Energy                                       | 189 (0.93)                      | 95247 (1.64)   | 31749.00                                     | 167.98                   | 31.70              |
| 07   | Biochemistry, Genetics and Molecular Biology | 1036 (5.09)                     | 452303 (7.79)  | 150767.70                                    | 145.53                   | 56.62              |
| 08   | Immunology and Microbiology                  | 296 (1.46)                      | 120856 (2.08)  | 40285.33                                     | 136.10                   | 57.07              |
| 09   | Pharmacology, Toxicology and Pharmaceutics   | 368 (1.81)                      | 136525 (2.35)  | 45508.33                                     | 123.66                   | 43.24              |
| 10   | Neuroscience                                 | 299 (1.47)                      | 107899 (1.86)  | 35966.33                                     | 120.29                   | 54.93              |
| 11   | Engineering                                  | 1228 (6.04)                     | 425560 (7.33)  | 141853.3                                     | 115.52                   | 28.64              |
| 12   | Veterinary                                   | 120 (0.59)                      | 41538 (0.72)   | 13846.00                                     | 115.38                   | 29.94              |
| 13   | Medicine                                     | 3330 (16.37)                    | 1097778 (18.91)  | 365926.00                                    | 109.89                   | 33.70              |
| 14   | Environmental Science                        | 715 (3.52)                      | 214493 (3.70)  | 71497.67                                     | 100.00                   | 33.46              |

|    |                                      |                    |                         |                           |       |       |
|----|--------------------------------------|--------------------|-------------------------|---------------------------|-------|-------|
| 15 | Agricultural and Biological Sciences | 1018 (5.01)        | 277300 (4.78)           | 92433.33                  | 90.80 | 35.27 |
| 16 | Earth and Planetary Sciences         | 623 (3.06)         | 164086 (2.83)           | 54695.33                  | 87.79 | 32.12 |
| 17 | Mathematics                          | 687 (3.38)         | 166302 (2.87)           | 55434.00                  | 80.69 | 27.42 |
| 18 | Health Professions                   | 241 (1.19)         | 57922 (1.00)            | 19307.33                  | 80.11 | 27.32 |
| 19 | Computer Science                     | 694 (3.41)         | 166227 (2.86)           | 55409.00                  | 79.84 | 30.80 |
| 20 | Nursing                              | 272 (1.34)         | 64340 (1.11)            | 21446.67                  | 78.85 | 22.23 |
| 21 | Dentistry                            | 89 (0.44)          | 20697 (0.36)            | 6899.00                   | 77.52 | 29.92 |
| 22 | Decision Sciences                    | 178 (0.88)         | 34073 (0.59)            | 11357.67                  | 63.81 | 32.28 |
| 23 | Psychology                           | 518 (2.55)         | 90802 (1.56)            | 30267.33                  | 58.43 | 29.47 |
| 24 | Economics, Econometrics and Finance  | 525 (2.58)         | 86050 (1.48)            | 28683.33                  | 54.63 | 23.49 |
| 25 | Business, Management and Accounting  | 685 (3.37)         | 96601 (1.66)            | 32200.33                  | 47.01 | 23.59 |
| 26 | Social Sciences                      | 3121 (15.35)       | 327435 (5.64)           | 109145.00                 | 34.97 | 15.80 |
| 27 | Arts and Humanities                  | 2156 (10.60)       | 193770 (3.34)           | 64590.00                  | 29.96 | 9.98  |
|    | Total (Average)*                     | 20336<br>(753.18)* | 5804504<br>(214981.62)* | 1934834.67<br>(71660.54)* | 95.14 | 30.12 |

Europe has always proved its research prowess across the world. In all 20336 research journals from Europe are indexed by the SCOPUS at an average of 753.18 research journals in each subject discipline. On average, during the period of study, 214981.42 research articles were published in each subject discipline across the Europe at an average of 71660.54 research articles each year. Compared to Asia, the Journal Packing Density of the research journals published from Europe is quite low, viz., 95.14 research articles per volume of each research journal. Chemistry is the leading subject discipline from the Europe, having the highest average JPD of 286.83 research articles published in each volume of the chemistry research journals. Journals based on the multidisciplinary sciences and Physics & Astronomy are the other two leading subject disciplines having JPD of 277.97 and 239.30 research articles respectively, while as, Arts & Humanities has recorded the lowest JPD of 29.96 research articles per volume. Nearly 48% subject disciplines from the Europe have registered the JPD below average JPD of the Europe. Like Africa and Asia, Medicine has (3330, 16.37%) research journals indexed by the SCOPUS, highest among all the subject disciplines in the Europe. Social Science and Aarts& Humanities are the other two leading subject disciplines to have (3121, 15.35%) and (2156, 10.60%) research journals indexed by the SCOPUS from Europe. The number of research journals published on the multidisciplinary basis from the Europe is quite low, in fact lowest among all the other subject disciplines. However the JPD of Multidisciplinary journals published from Europe like other continents is quite high.

**Table-4 JPD of research journals published across different subject disciplines in South America**

| Rank | Subject field     | Number of Journals<br>(% Share) | Research articles<br>published<br>2013-15<br>(% Share) | Average<br>articles<br>published<br>per year | Avg JPD<br>per<br>Volume | H_index<br>Average |
|------|-------------------|---------------------------------|--|--|--------------------------|--------------------|
| 01   | Decision Sciences | 2 (0.22)                        | 709 (0.48)   | 236.33                                       | 118.17                   | 7.00               |

|    |  |               |                      |                        |        |       |
|----|--|---------------|----------------------|------------------------|--------|-------|
| 02 | Multidisciplinary                            | 4 (0.45)      | 1239 (0.84)          | 413.00                 | 103.25 | 25.50 |
| 03 | Nursing                                      | 13 (1.46)     | 3459 (2.34)          | 1153.00                | 88.69  | 12.62 |
| 04 | Veterinary                                   | 22 (2.47)     | 5796 (3.92)          | 1932.00                | 87.82  | 9.14  |
| 05 | Biochemistry, Genetics and Molecular Biology | 24 (2.69)     | 6220 (4.21)          | 2073.33                | 86.39  | 17.63 |
| 06 | Pharmacology, Toxicology and Pharmaceutics   | 13 (1.46)     | 3264 (2.21)          | 1088.00                | 83.69  | 16.15 |
| 07 | Chemistry                                    | 16 (1.80)     | 3805 (2.57)          | 1268.33                | 79.27  | 13.38 |
| 08 | Immunology and Microbiology                  | 12 (1.35)     | 2851 (1.93)          | 950.33                 | 79.19  | 21.17 |
| 09 | Medicine                                     | 187 (20.99)   | 41107 (27.80)        | 13702.33               | 73.27  | 11.78 |
| 10 | Dentistry                                    | 9 (1.01)      | 1975 (1.34)          | 658.33                 | 73.15  | 12.22 |
| 11 | Physics and Astronomy                        | 8 (0.90)      | 1749 (1.18)          | 583.00                 | 72.88  | 11.50 |
| 12 | Neuroscience                                 | 11 (1.23)     | 2261 (1.53)          | 753.67                 | 68.52  | 14.27 |
| 13 | Agricultural and Biological Sciences         | 126 (14.14)   | 24684 (16.69)        | 8228.00                | 65.30  | 12.48 |
| 14 | Health Professions                           | 8 (0.90)      | 1559 (1.05)          | 519.67                 | 64.96  | 8.75  |
| 15 | Chemical Engineering                         | 6 (0.67)      | 1162 (0.79)          | 387.33                 | 64.56  | 15.33 |
| 16 | Energy                                       | 2 (0.22)      | 381 (0.26)           | 127.00                 | 63.50  | 14.00 |
| 17 | Materials Science                            | 15 (1.68)     | 2807 (1.90)          | 935.67                 | 62.38  | 9.00  |
| 18 | Business, Management and Accounting          | 11 (1.23)     | 1954 (1.32)          | 651.33                 | 59.21  | 6.64  |
| 19 | Environmental Science                        | 29 (3.25)     | 4365 (2.95)          | 1455.00                | 50.17  | 9.38  |
| 20 | Engineering                                  | 31 (3.48)     | 4572 (3.09)          | 1524.00                | 49.16  | 7.26  |
| 21 | Computer Science                             | 6 (0.67)      | 880 (0.60)           | 293.33                 | 48.89  | 8.50  |
| 22 | Mathematics                                  | 9 (1.01)      | 1196 (0.81)          | 398.67                 | 44.30  | 5.78  |
| 23 | Earth and Planetary Sciences                 | 36 (4.04)     | 3973 (2.69)          | 1324.33                | 36.79  | 11.08 |
| 24 | Psychology                                   | 31 (3.48)     | 3392 (2.29)          | 1130.67                | 36.47  | 6.26  |
| 25 | Social Sciences                              | 156 (17.51)   | 14850 (10.04)        | 4950.00                | 31.73  | 4.44  |
| 26 | Arts and Humanities                          | 84 (9.43)     | 6308 (4.27)          | 2102.67                | 25.03  | 2.37  |
| 27 | Economics, Econometrics and Finance          | 20 (2.24)     | 1365 (0.92)          | 455.00                 | 22.75  | 5.30  |
|    | Total (Average)*                             | 891<br>(33) * | 147883<br>(5477.14)* | 49294.33<br>(1825.71)* | 55.32  | 9.32  |

South America is one of the developing continents in the world, which by and large is an abode of poor nation states, as such have limited resources to undertake research activities on a large scale. Anyhow, as on date 891 research journals are published across the continent in 27 different subject disciplines at an average of 33 research journals in each subject discipline. During the period of study, on average, 5477.14 research articles have been published in each subject discipline at an average of 1825.71 research articles each year. The average JPD of the research journals published from published from South America is 55.32 research articles each volume. Although only two journals from the Decision science are indexed by SCOPUS from the South America, the lowest among all the subject disciplines along with Energy has recorded the highest JPD,118.70 research articles in each volume of the journal. It is quite understandable here, that the journals pertaining to the Decision Sciences published from the South America face the pressure of publishing, hence recorded the maximum JPD. Research journals published in the Multidisciplinary Sciences and Nursing are the other two subject disciplines which have recoded the JPD of 103.25 and 88.69 research articles each volume, while as Economics, Econometrics and Finance has recorded the lowest JPD of 22.75 research articles per volume. Medicine, Social Science and Agriculture & Biological sciences are the three leading subject disciplines from the

South America to have a maximum number of research journals indexed by the SCOPUS, while as, Decision Science and Energy have the minimum 2 research journals each. Nearly 33% subject disciplines from the South America have less than the average JPD of the continent.

**Table-5 JPD of research journals published across different subject disciplines in North America**

| Rank | Subject field                                | Number of Journals (% Share) | Research articles published 2013-15 (% Share) | Average articles published per year | Avg JPD per Volume | H_index Average |
|------|--|------------------------------|---|-------------------------------------|--------------------|-----------------|
| 01   | Multidisciplinary                            | 19 (0.19)                    | 26736 (0.72)                                  | 8912.00                             | 469.05             | 97.42           |
| 02   | Physics and Astronomy                        | 274 (2.68)                   | 265178 (7.18)                                 | 88392.67                            | 322.60             | 57.64           |
| 03   | Chemistry                                    | 197 (1.93)                   | 177420 (4.81)                                 | 59140.00                            | 300.20             | 68.78           |
| 04   | Biochemistry, Genetics and Molecular Biology | 544 (5.32)                   | 406583 (11.02)                                | 135527.70                           | 249.13             | 77.97           |
| 05   | Materials Science                            | 285 (2.79)                   | 181866 (4.93)                                 | 60622.00                            | 212.71             | 42.10           |
| 06   | Immunology and Microbiology                  | 131 (1.28)                   | 80817 (2.19)                                  | 26939.00                            | 205.64             | 73.66           |
| 07   | Chemical Engineering                         | 129 (1.26)                   | 73518 (1.99)                                  | 24506.00                            | 189.97             | 49.81           |
| 08   | Agricultural and Biological Sciences         | 401 (3.92)                   | 212808 (5.77)                                 | 70936.00                            | 176.90             | 43.94           |
| 09   | Neuroscience                                 | 149 (1.46)                   | 76168 (2.06)                                  | 25389.33                            | 170.40             | 75.34           |
| 10   | Energy                                       | 107 (1.05)                   | 50718 (1.37)                                  | 16906.00                            | 158.00             | 31.73           |
| 11   | Medicine                                     | 1841 (18.01)                 | 840780 (22.78)                                | 280260.00                           | 152.23             | 51.01           |
| 12   | Dentistry                                    | 41 (0.40)                    | 16689 (0.45)                                  | 5563.00                             | 135.68             | 50.80           |
| 13   | Pharmacology, Toxicology and Pharmaceutics   | 176 (1.72)                   | 66022 (1.79)                                  | 22007.33                            | 125.04             | 50.28           |
| 14   | Engineering                                  | 713 (6.97)                   | 265299 (7.19)                                 | 88433.00                            | 124.03             | 35.04           |
| 15   | Environmental Science                        | 279 (2.73)                   | 98285 (2.66)                                  | 32761.67                            | 117.43             | 36.88           |
| 16   | Mathematics                                  | 385 (3.77)                   | 130007 (3.25)                                 | 43335.67                            | 112.56             | 34.76           |
| 17   | Earth and Planetary Sciences                 | 199 (1.95)                   | 61456 (1.67)                                  | 20485.33                            | 102.94             | 43.57           |
| 18   | Veterinary                                   | 36 (0.35)                    | 10685 (0.29)                                  | 3561.67                             | 98.94              | 35.08           |
| 19   | Health Professions                           | 179 (1.75)                   | 50352 (1.36)                                  | 16784.00                            | 93.77              | 41.27           |
| 20   | Nursing                                      | 236 (2.31)                   | 61144 (1.66)                                  | 20381.33                            | 86.36              | 35.55           |
| 21   | Computer Science                             | 451 (4.41)                   | 107203 (2.90)                                 | 35734.33                            | 79.23              | 38.63           |
| 22   | Decision Sciences                            | 96 (0.94)                    | 16098 (0.44)                                  | 5366.00                             | 55.90              | 37.72           |
| 23   | Psychology                                   | 456 (4.46)                   | 70704 (1.92)                                  | 23568.00                            | 51.68              | 45.62           |
| 24   | Business, Management and Accounting          | 359 (3.51)                   | 45463 (1.23)                                  | 15154.33                            | 42.21              | 28.26           |
| 25   | Arts and Humanities                          | 867 (8.48)                   | 106682 (2.89)                                 | 35560.67                            | 41.02              | 20.35           |
| 26   | Economics, Econometrics and Finance          | 213 (2.08)                   | 26088 (0.71)                                  | 8696.00                             | 40.83              | 31.88           |
| 27   | Social Sciences                              | 1461 (14.29)                 | 166093 (4.50)                                 | 55364.33                            | 37.89              | 21.91           |
|      | Total (Average)*                             | 10224 (378.66)*              | 3690862 (136698.59)*                          | 1230287.33 (45566.19)*              | 120.33             | 41.23           |

North America like Europe is also known for its research prowess for the countries like The US and the Canada, which are contributing significantly to the global research output. In all 10224 research journals from North America are indexed by the SCOPUS in 27 different subject disciplines at an average of 378.66 research journals in each subject discipline. During the period of study, on average, 136698.59 research articles were published in each subject discipline at an average of 45566.19 research articles each year. Research journals published in the field of Multidisciplinary Sciences from the North America have the maximum JPD of 469.05 research articles per volume. But, it is

equally noteworthy here that only 19 journals are published as multidisciplinary, the minimum among the entire subject discipline under study. The average JPD of the research journals published from the continent is 120.33 research articles per volume. Physics & Astronomy and Chemistry are the other two leading subject disciplines to have the average JPD of 322.60 and 300.20 research articles per volume respectively. Social Sciences have the lowest JPD of 37.89 research articles per journal per volume. Nearly 48% subject disciplines under study from the continent have less than the average JPD of the Continent. Medicine (1841, 18.01%), Social Science (1461, 14.29%) and Arts & Humanities (867, 8.39%) are the three leading subject disciplines to have the maximum number of research journals indexed by the SCOPUS.

**Table-6 JPD of research journals published across different subject disciplines in Oceania**

| Rank | Subject field                                | Number of Journals<br>(% Share) | Research articles<br>published<br>2013-15<br>(% Share) | Average<br>articles<br>published<br>per year | Avg JPD<br>per<br>Volume | H_index<br>Average |
|------|--|---------------------------------|--|--|--------------------------|--------------------|
| 01   | Chemical Engineering                         | 4 (0.68)                        | 1854 (2.25)  | 618.00                                       | 154.50                   | 31.25              |
| 02   | Chemistry                                    | 7 (1.19)                        | 2563 (3.11)  | 854.33                                       | 122.05                   | 32.00              |
| 03   | Materials Science                            | 5 (0.85)                        | 1746 (2.12)  | 582.00                                       | 116.40                   | 16.20              |
| 04   | Agricultural and Biological Sciences         | 63 (10.68)                      | 15799 (19.19)  | 5266.33                                      | 83.59                    | 24.16              |
| 05   | Veterinary                                   | 3 (0.51)                        | 703 (0.85)   | 234.33                                       | 78.11                    | 31.67              |
| 06   | Health Professions                           | 13 (2.20)                       | 2701 (3.28)  | 900.33                                       | 69.26                    | 19.62              |
| 07   | Nursing                                      | 17 (2.88)                       | 3381 (4.11)  | 1127.00                                      | 66.29                    | 14.06              |
| 08   | Medicine                                     | 122 (20.68)                     | 22979 (27.92)  | 7659.67                                      | 62.78                    | 16.01              |
| 09   | Pharmacology, Toxicology and Pharmaceutics   | 19 (3.22)                       | 3517 (4.27)  | 1172.33                                      | 61.70                    | 16.79              |
| 10   | Dentistry                                    | 6 (1.02)                        | 748 (0.91)   | 249.33                                       | 41.56                    | 24.17              |
| 11   | Neuroscience                                 | 6 (1.02)                        | 699 (0.85)   | 233.00                                       | 38.83                    | 10.67              |
| 12   | Immunology and Microbiology                  | 5 (0.85)                        | 544 (0.66)   | 181.33                                       | 36.27                    | 14.60              |
| 13   | Biochemistry, Genetics and Molecular Biology | 31 (5.25)                       | 3355 (4.08)  | 1118.33                                      | 36.08                    | 14.65              |
| 14   | Earth and Planetary Sciences                 | 17 (2.88)                       | 1765 (2.14)  | 588.33                                       | 34.61                    | 23.12              |
| 15   | Environmental Science                        | 30 (5.08)                       | 3017 (3.67)  | 1005.67                                      | 33.52                    | 23.80              |
| 16   | Physics and Astronomy                        | 2 (0.34)                        | 181 (0.22)   | 60.33  | 30.16                    | 7.00               |
| 17   | Engineering                                  | 19 (3.22)                       | 1713 (2.08)  | 571.00                                       | 30.05                    | 9.16               |
| 18   | Psychology                                   | 15 (2.54)                       | 1185 (1.44)  | 395.00                                       | 26.33                    | 12.93              |
| 19   | Mathematics                                  | 5 (0.85)                        | 387 (0.47)   | 129.00                                       | 25.80                    | 8.80               |
| 20   | Economics, Econometrics and Finance          | 13 (2.20)                       | 984 (1.20)   | 328.00                                       | 25.23                    | 11.69              |
| 21   | Social Sciences                              | 103 (17.46)                     | 7598 (9.23)  | 2532.67                                      | 24.59                    | 9.10               |
| 22   | Business, Management and Accounting          | 22 (3.73)                       | 1584 (1.92)  | 528.00                                       | 24.00                    | 10.86              |
| 23   | Energy                                       | 1 (0.17)                        | 71 (0.09)  | 23.67  | 23.67                    | 16.00              |
| 24   | Decision Sciences                            | 3 (0.51)                        | 211 (0.26)   | 70.33  | 23.44                    | 13.00              |
| 25   | Arts and Humanities                          | 46 (7.80)                       | 2448 (2.97)  | 816.00                                       | 17.74                    | 5.91               |
| 26   | Multidisciplinary                            | 2 (0.34)                        | 99 (0.12)  | 33.00  | 16.50                    | 17.50              |
| 27   | Computer Science                             | 11 (1.86)                       | 478 (0.58)   | 159.33                                       | 14.48                    | 9.45               |
|      | Total (Average)*                             | 590<br>(21.85)*                 | 82310<br>(3048.51)*                                    | 27436.67<br>(1016.17)*                       | 46.50                    | 15.04              |

Australia or Oceania is one of the smallest continents in the world. The continent is also known as Australia, because Australia is the largest country on this continent apart from other smaller nation states like New Zealand, Naru, Fiji etc. Australia and New

Zealand are the two main research countries from the Oceania which contribute to the global research output. In all 590 research journals from Oceania are indexed by the SCOPUS in 27 different subject disciplines at an average of 21.85 research journals in each subject discipline. During the period of study, on average, 3048.51 research articles were published in each subject discipline at an average of 1016.17 research articles each year. The average JPD of the research journals published from the Oceania is 46.50 research articles per volume. Chemical Engineering is the leading subject discipline to have JPD of 154.50 research articles per volume. Chemical Engineering is followed by Chemistry and Material Sciences having average JPD of 122.05 and 116.40 research articles per volume. Computer Sciences has the lowest average JPD of 14.48 research articles per journal per volume. Nearly 66% subject disciplines have less than the average JPD of the continent. Medicine (122, 20.68%), Social Sciences (103, 17.46%) and Agriculture & Biological Sciences (63, 10.68%) are the three leading subject disciplines to have the maximum number of research journals indexed by the SCOPUS. Energy is the only subject discipline which has only one research journal indexed.

**Table-7 JPD of research journals published across different subject disciplines at global level**

| S.No | Subject field                                | Number of Journals (% Share) | Total research articles published 2013-15 (% Share) | Average articles published per year | Avg JPD per Volume | H_index Average |
|------|--|------------------------------|---|-------------------------------------|--------------------|-----------------|
| 01   | Chemistry                                    | 800 (2.22)                   | 639984 (5.81)                                       | 218828.00                           | 266.66             | 51.91           |
| 02   | Physics and Astronomy                        | 969 (2.69)                   | 738143 (6.70)                                       | 246047.70                           | 253.92             | 46.69           |
| 03   | Multidisciplinary                            | 110 (0.30)                   | 80035 (0.73)  | 26678.33                            | 242.53             | 38.15           |
| 04   | Chemical Engineering                         | 536 (1.49)                   | 305506 (2.77)                                       | 101835.30                           | 189.99             | 41.08           |
| 05   | Materials Science                            | 1117 (3.10)                  | 630351 (5.72)                                       | 210117.00                           | 188.11             | 35.89           |
| 06   | Biochemistry, Genetics and Molecular Biology | 1857 (5.15)                  | 944857 (8.57)                                       | 314952.30                           | 169.60             | 56.96           |
| 07   | Energy                                       | 369 (1.02)                   | 177424 (1.61)                                       | 59141.33                            | 160.27             | 28.03           |
| 08   | Immunology and Microbiology                  | 510 (1.41)                   | 223445 (2.03)                                       | 74481.67                            | 146.04             | 54.98           |
| 09   | Neuroscience                                 | 499 (1.38)                   | 194611 (1.77)                                       | 64870.33                            | 130.00             | 56.57           |
| 10   | Engineering                                  | 2472 (6.85)                  | 906658 (8.23)                                       | 302219.30                           | 122.26             | 27.15           |
| 11   | Pharmacology, Toxicology and Pharmaceutics   | 724 (2.01)                   | 263443 (2.39)                                       | 87814.33                            | 121.29             | 37.86           |
| 12   | Medicine                                     | 6355 (17.61)                 | 2265611 (20.55)                                     | 755203.70                           | 118.84             | 34.93           |
| 13   | Veterinary                                   | 214 (0.59)                   | 68665 (0.62)  | 22888.33                            | 106.95             | 26.20           |
| 14   | Agricultural and Biological Sciences         | 1887 (5.23)                  | 602833 (5.47)                                       | 200944.30                           | 106.49             | 32.03           |
| 15   | Environmental Science                        | 1185 (3.28)                  | 359155 (3.26)                                       | 119718.30                           | 101.03             | 31.08           |
| 16   | Mathematics                                  | 1253 (3.47)                  | 344866 (3.13)                                       | 114955.30                           | 91.74              | 27.74           |
| 17   | Earth and Planetary Sciences                 | 1045 (2.90)                  | 282185 (2.56)                                       | 94061.67                            | 90.01              | 30.77           |
| 18   | Dentistry                                    | 169 (0.47)                   | 44681 (0.41)  | 14893.67                            | 88.13              | 31.25           |
| 19   | Computer Science                             | 1333 (3.69)                  | 338747 (3.07)                                       | 112915.70                           | 84.71              | 31.19           |
| 20   | Health Professions                           | 463 (1.28)                   | 115878 (1.05)                                       | 38626.00                            | 83.43              | 31.33           |
| 21   | Nursing                                      | 572 (1.59)                   | 138723 (1.26)                                       | 46241.00                            | 80.84              | 26.65           |
| 22   | Decision Sciences                            | 298 (0.83)                   | 52995 (0.48)  | 17665.00                            | 59.28              | 32.42           |
| 23   | Psychology                                   | 1044 (2.89)                  | 168570 (1.53)                                       | 56190.00                            | 53.82              | 35.13           |

|    |                                     |                     |                          |                            |        |       |
|----|-------------------------------------|---------------------|--------------------------|----------------------------|--------|-------|
| 24 | Economics, Econometrics and Finance | 822 (2.28)          | 121045 (1.10)            | 40348.33                   | 49.09  | 23.93 |
| 25 | Business, Management and Accounting | 1152 (3.19)         | 152977 (1.39)            | 50992.33                   | 44.26  | 23.53 |
| 26 | Social Sciences                     | 5068 (14.05)        | 542537 (4.92)            | 180845.70                  | 35.68  | 16.66 |
| 27 | Arts and Humanities                 | 3258 (9.03)         | 319197 (2.90)            | 106399.00                  | 32.66  | 12.28 |
|    | Total (Average)*                    | 36081<br>(1336.33)* | 11023122<br>(408263.77)* | 3674374.00<br>(136087.92)* | 101.84 | 30.65 |

Table -7 is the compilation based on the table-1 to 6. In all, 36081 research journals are indexed by the SCOPUS all across the globe in 27 subject disciplines under study at an average of 1336.33 research journals published against each subject discipline. The average Journal Packing Density of the research journals at the global level is 101.84 research articles per volume. Chemistry is the leads the table with the average JPD of 266.66 research articles per volume. Chemistry is followed by Physics & Astronomy and Multidisciplinary journals with an average JPD of 253.92 and 242.53 research articles per volume, respectively. Arts & Humanities subject discipline has the lowest JPD of 32.66 research articles per volume at the global level. Nearly 48% subject disciplines have less than the average global JPD. Medicine (6355, 17.61%) is the leading subject discipline at the global level, having a major share of the research journals indexed by the SCOPUS at the global level. Medicine is followed by the Social Sciences (5068, 14.05%) and Arts & Humanities (3258, 9.03%) as the other two leading subject disciplines at the global level. During the period of study, on average, 408263.77 research articles were published in each subject discipline at an average of 136087.92 research articles each year.

**Table-8 Comparative JPD of research journals published across continents**

| S.No | Subject                                      | Africa | Asia   | Europe | South America | North America | Oceania | world  |
|------|--|--------|--------|--------|---------------|---------------|---------|--------|
| 01   | Agricultural and Biological Sciences         | 42.22  | 90.46  | 90.80  | 65.30         | 176.90        | 83.59   | 106.49 |
| 02   | Arts and Humanities                          | 32.33  | 31.61  | 29.96  | 25.03         | 41.02         | 17.74   | 32.66  |
| 03   | Biochemistry, Genetics and Molecular Biology | 44.50  | 118.02 | 145.53 | 86.39         | 249.13        | 36.08   | 169.60 |
| 04   | Business, Management and Accounting          | 26.22  | 33.05  | 47.01  | 59.21         | 42.21         | 24.00   | 44.26  |
| 05   | Chemical Engineering                         | -      | 126.46 | 213.24 | 64.56         | 189.97        | 154.50  | 189.99 |
| 06   | Chemistry                                    | 40.56  | 171.35 | 286.83 | 79.27         | 300.20        | 122.05  | 266.66 |
| 07   | Computer Science                             | 25.24  | 128.92 | 79.84  | 48.89         | 79.23         | 14.48   | 84.71  |
| 08   | Decision Sciences                            | 20.83  | 34.88  | 63.81  | 118.17        | 55.90         | 23.44   | 59.28  |
| 09   | Dentistry                                    | -      | 63.50  | 77.52  | 73.15         | 135.68        | 41.56   | 88.13  |
| 10   | Earth and Planetary Sciences                 | 45.53  | 103.21 | 87.79  | 36.79         | 102.94        | 34.61   | 90.01  |
| 11   | Economics, Econometrics and Finance          | 17.83  | 46.20  | 54.63  | 22.75         | 40.83         | 25.23   | 49.09  |
| 12   | Energy                                       | 59.17  | 150.25 | 167.98 | 63.50         | 158.00        | 23.67   | 160.27 |
| 13   | Engineering                                  | 57.24  | 147.83 | 115.52 | 49.16         | 124.03        | 30.05   | 122.26 |
| 14   | Environmental Science                        | 50.73  | 104.59 | 100.00 | 50.17         | 117.43        | 33.52   | 101.03 |
| 15   | Health Professions                           | 24.83  | 53.25  | 80.11  | 64.96         | 93.77         | 69.26   | 83.43  |



|    |  |       |        |        |        |        |        |        |
|----|--|-------|--------|--------|--------|--------|--------|--------|
| 16 | Immunology and Microbiology                | 51.78 | 99.29  | 136.10 | 79.19  | 205.64 | 36.27  | 146.04 |
| 17 | Materials Science                          | 72.39 | 134.05 | 197.76 | 62.38  | 212.71 | 116.40 | 188.11 |
| 18 | Mathematics                                | 57.30 | 95.84  | 80.69  | 44.30  | 112.56 | 25.80  | 91.74  |
| 19 | Medicine                                   | 57.11 | 105.36 | 109.89 | 73.27  | 152.23 | 62.78  | 118.84 |
| 20 | Multidisciplinary                          | 45.00 | 175.49 | 277.97 | 103.25 | 469.05 | 16.50  | 242.53 |
| 21 | Neuroscience                               | 41.56 | 77.53  | 120.29 | 68.52  | 170.40 | 38.83  | 130.00 |
| 22 | Nursing                                    | 37.11 | 68.23  | 78.85  | 88.69  | 86.36  | 66.29  | 80.84  |
| 23 | Pharmacology, Toxicology and Pharmaceutics | 64.54 | 125.16 | 123.66 | 83.69  | 125.04 | 61.70  | 121.29 |
| 24 | Physics and Astronomy                      | 26.89 | 199.34 | 239.30 | 72.88  | 322.60 | 30.16  | 253.92 |
| 25 | Psychology                                 | 33.83 | 34.68  | 58.43  | 36.47  | 51.68  | 26.33  | 53.82  |
| 26 | Social Sciences                            | 26.61 | 40.75  | 34.97  | 31.73  | 37.89  | 24.59  | 35.68  |
| 27 | Veterinary                                 | 46.11 | 105.87 | 115.38 | 87.82  | 98.94  | 78.11  | 106.95 |
|    | average                                    | 41.90 | 111.81 | 95.14  | 55.32  | 120.33 | 46.50  | 101.84 |

Asia and North America are the only continents which have JPD above the average global JPD while as, the rest of the continents have JPD below the average JPD of the world.

North America leads in the JPD among subject disciplines like Agricultural and Biological Sciences, Arts and Humanities, Biochemistry, Genetics and Microbiology, Chemistry, Dentistry, Environmental Sciences, Health Profession, Immunology and Microbiology, Material Sciences, Mathematics, Medicine, Multidisciplinary Journals, Neuroscience and Physics and Astronomy,

South America leads in the JPD in the subject disciplines like Business, Management and Accounting, Decision Science and Nursing.

Europe leads in the Chemical Engineering, across continents. Africa Agriculture and Business Science, Economics, Econometrics and Finance, Energy, Psychology and Veterinary Sciences

Asia, Computer Sciences, Earth and Planetary Sciences, Engineering, Pharmacology, Toxicology and Pharmaceutics and Social Sciences

**Table-9 Average JPD across Continents**

| Rank | Name of the Continent | Number of Journals (% Share) | Research articles published 2013-15 (% Share) | Average articles published per year | Avg JPD per Volume | H_index Average |
|------|-----------------------|------------------------------|---|-------------------------------------|--------------------|-----------------|
| 01   | Africa                | 294 (0.81)                   | 41082 (0.37)                                  | 13694.00                            | 46.58              | 11.88           |
| 02   | Asia                  | 3746 (10.38)                 | 1256481 (11.40)                               | 418827.00                           | 111.81             | 13.69           |
| 03   | Europe                | 20336 (56.36)                | 5804504 (52.66)                               | 1934834.67                          | 95.14              | 30.12           |
| 04   | South America         | 891 (1.34)                   | 147883 (1.34)                                 | 49294.33                            | 55.32              | 9.32            |
| 05   | Northern America      | 10224 (33.48)                | 3690862 (33.48)                               | 1230287.33                          | 120.33             | 41.23           |
| 06   | Oceania               | 590 (0.75)                   | 82310 (0.75)                                  | 27436.67                            | 46.50              | 15.04           |
|      | Total (Average)*      | 36081                        | 11023122                                      | 3674374.00                          | 101.84             | 30.65           |

|  |  |            |            |              |  |  |
|--|--|------------|------------|--------------|--|--|
|  |  | (6013.50)* | (1837187)* | (612395.66)* |  |  |
|--|--|------------|------------|--------------|--|--|

Of the total research journals indexed by SCOPUS in the subject disciplines under study across the world, 294 (0.81%) are from Africa, 3746 (10.38%) from Asia, 20336 (56.36%) from Europe, 891 (1.34%) from South America, 10224 (33.48%) from North America and 590 (0.75%) from Oceania. Asia and North America are the only continents which have JPD above the average JPD of the World. Research journals published from the Africa and the Oceania on average publish less than 50 research articles per volume, which is more than 50% lesser to the average research articles published per volume of the research journal at the global level.

On average 6013.50 research journals are indexed by SCOPUS from each individual continent. During the period of study on average, 1837187 research articles were published in the research journals from each individual continent and on average each year 612395.66 research articles were published in the research journals published from each individual continent.

**DISCUSSION AND CONCLUSION:** Researchers all across the world always aspire to publish their research results in the leading research journals published in their subject discipline. Every time a researcher comes up with new research findings, he/she intends to publish research results in a research journal which has a higher impact factor than the research journal he/she may have published last time. So this unending quest for better and better pushes things beyond the limits and the increase in JPD of good research journals is an outcome of this unending human contention. Research journals indexed by popular indexes like, WoS, SCOPUS, Ulrich's Periodical Directory etc., always receive abundance of manuscripts for publishing, which apart from inflating the JPD of research journals also cause a lot of delay in publishing the results, due to an unending queue of research articles awaiting their turn to get published.

The average JPD of research journals published across the world is 101.84 research articles per journal per volume. While as, the average JPD of research journals published across different continents varies considerably. The average JPD of research Journals published across North America is 120.33 research articles per journal per volume, Asia 111.81 research articles, Europe 95.14 research articles, South America 55.32 research articles, Africa 46.58 research articles and Oceania 46.50 research articles per journal per volume. North America and Asia are the only continents, which have average JPD above the average global JPD. Similarly, in terms of scientific output, 52.66% of the total global research output has been published alone in the research

journals published across Europe, which is followed by North America with a share percentage of 33.48%. While as the rest 13.86 %, research articles were published in the research journals published across Africa, Asia, South America and Oceania.

Chemistry is the leading subject discipline to have the average JPD of 266.66 research articles per journal per volume at the global level. This also reflects the fact that the amount of research undertaken in the Chemistry across the world and the pressure of publishing on the research journals published in the subject discipline of Chemistry is quite higher than the other subject disciplines. It is quite interesting to note that of the total global research output published during the period of study, 5.81% has been published in Chemistry. What is more noteworthy is that of the total research journal indexed by the SCOPUS at the global level across different subject disciplines, only 2.22% are from Chemistry. The existing difference between the research output and the research journals published in the subject discipline of Chemistry indicates towards the fact that the natural balance between the research output share and the research journals share is not in harmony with each other, hence results into the increased JPD of the Chemistry. The existing deficiency of 3.59% of research journals in the subject discipline of Chemistry has put extra publishing pressure on the existing lot of journals, which in a way have to accommodate the research articles of 3.59% unpublished research journals of chemistry. On the contrary, if we look at the subject discipline Environmental Sciences, which has research share of 3.26% and has a journal share of 3.28%, at the global level, which means the difference of 0.02% between the research and journal share, hence the JPD of research journals published in the Environmental Sciences is almost equal to the average global JPD. Thereby, it can be emphatically said, that research journals need to grow almost at a constant pace to that of growth in scientific output of a particular subject discipline.

Popularity of subject discipline as the most sought research area in a particular country or a continent can be ascertained by evaluating the overall research output of a subject discipline among other subject areas. Accordingly, with 20.55% of the global research share, Medicine can be considered as the most sought research discipline across the world. Biochemistry, Genetics & Molecular Biology and Engineering are the other two most sought research disciplines at the global level given their research share at the global level. If we look at the popularity of subject disciplines at the continental level, then again Medicine is the most sought research discipline across all the continents under study. Medicine in Africa has a research share of 39.20%, Asia 19.65%, Europe 18.91%, South America 27.80%, North America 22.78% and Oceania 27.92% research share. If we look at the overall research share at the continental level, then of the total

scientific output from 2013-2015 at the global level, research journals published from Africa have published 0.37%, Asia 11.40%, Europe 52.66%, South America 1.34%, North America 33.48% and Oceania 0.75% in the research journals published from Oceania.

The subject disciplines like, chemistry, Physics and Astronomy, Multidisciplinary Journals, Chemical Engineering, Material Sciences, Biochemistry and Energy some of the leading subject disciplines, which have a disproportionate distribution of research output and the research journals published in these subject disciplines. In order to regulate the JPD of these subject disciplines around the average global JPD, there is a far greater need to index more and more research journals by the SCOPUS and other leading journal indexes across different continents on a proportionate basis without compromising with the quality parameters.

The JPD density of each leading individual subject at the continental level also somewhere reflects the popularity of that particular subject discipline at the continental level. Like, Chemistry appears to be the most popular subject discipline in Europe for having recorded the highest JPD of 287.63 research articles per journal per volume. There is almost a direct correlation between the number of journals and the number of research articles published in a particular subject discipline. The subject fields having a major share among the journals have almost equally the major share in the number of research articles published across different subject discipline.

Continents from where a lesser number of research journals are indexed by the popular indexes like SCOPUS or Web of Science, face greater pressure of publishing and to ooze out this pressure, there is need to index more and more research journals from such countries and that can be done only by improving & maintaining the research standard over a period of time.

The Journal Packing Density of research journals published in the sciences is higher than the JPD of research journals published in the social sciences. Business, Management and Accounting, Social Sciences and Arts & Humanities are three subject disciplines having lowest JPD viz., 44.26, 35.68 and 32.66 research articles per journal per volume at the global level, respectively.

Journal Packing Density is generally determined by drawing the comparison between the research output and the number of research journals published in a particular subject discipline. The greater the researcher output higher will be JPD and lower the number of research journals published in a particular subject discipline, higher will be pressure on these journals to accommodate more and more research articles hence

inflates the JPD. There is a direct correlation between JPD and the number of research journals published in a particular subject discipline & the scientific productivity thereof

Subject disciplines in which a good number of research journals are published have JPD around the average JPD of the world, while as the subject disciplines in which lesser number of research journals are published have JPD greater than the average JPD of the world. Still more, there is a growing awareness among the research and scientific community about the predatory and fake scientific journals, as such there is a significant increase in the submission of manuscripts in the scholarly peer reviewed research journals.

It is quite interesting to note about the leading subject disciplines from different continents which have the highest or maximum JPD. Material Sciences is the leading subject discipline from Africa to have the highest JPD of 72.39 research articles per journal per volume. Similarly, Physics and Astronomy from Asia has the JPD of 199.34 research articles, Chemistry from Europe has JPD of 286.83 research articles, Decision Science from South America has JPD of 118.70 research articles, Multidisciplinary subjects from North America has the JPD of 469.05 research articles and Chemical engineering from Oceania has the JPD of 154.50 research articles per journal per volume. Any existing difference in the share percentage of research journals published in a particular subject discipline at the global or continental level and the research output share of that subject discipline at the global or continental level gets reflected in the JPD. Higher the JPD of a subject discipline lesser may be the number of research journals indexed in that particular subject discipline. It can be emphatically said that any existing difference in the research output share and the research journals share results into the inflation or deflation of the JPD of that particular subject discipline.

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